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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/636,161	08/10/2000	SHUMIN WANG	98124X205487	6517

29050 7590 09/12/2003

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24
EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 09/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/636,161

Applicant(s)

WANG ET AL.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 8, 9, 16-27 and 32-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8, 9, 16-27 and 32-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 3, 4, 8, 9, 16, 17, 19-22, 24-27, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman et al (US 5,783, 489).

Kaufman teaches, "A chemical mechanical polishing slurry comprising at least two oxidizing agents, an organic acid and an abrasive and a method for using the chemical mechanical polishing slurry to remove titanium, titanium nitride, and an aluminum alloy containing layer from a substrate" (Abstract), which reads on,

A system for polishing one or more layers of a multi-layer substrate that includes a first metal layer and a second layer comprising:

- (ii) at least one oxidizing agent and
- (v) an abrasive.

Kaufman also teaches, "... adding the metal oxide abrasive to an appropriate media, for example, deionized water (same as applicant's liquid carrier), ... (column 5, lines 60-63); "... a variety of optional additives, such as ... stabilizers, ... can be used. ... Nonlimiting examples of preferred stabilizers useful in the CMP slurry ... include but are not limited to phosphonic acids such as aminotri(methylenephosphonic) acid, 1-hydroxyethylidene-4-diphosphonic acid, hexamethylenediaminetetramethylene phosphonic acid, and diethylenetetramine pentamethylenephosphonic acid" (column 6, lines 39-54). The aforementioned further reads on,

- (i) a liquid carrier and

(iii) at least on polishing additive wherein the polishing additive is selected from the group consisting of diphosphonic acid, **in claim 1**. Since Kaufman teaches a cmp slurry that comprises the same additive as that of the claimed invention, then using Kaufman's additive in the same manner as in the claimed invention would result in increasing the rate at which the system polishes at least one layer of the substrate, as claimed in the present invention. The said aforementioned also reads on,

the liquid carrier is water, **in claim 3**;

wherein the system comprises an abrasive suspended in the liquid carrier, **in claim 4**; and

wherein at least one polishing additive is selected from the group consisting of diphosphonic acids as recited, **in claims 9 and 19.**

Kaufman teaches, "... the use of an acid or base that contains no metal ions, such as ammonium hydroxide and amines (same as applicant's stopping compound) . . ." (column 7, lines 29-31); and "... additives . . . includes . . . ammonium salts, . . ." (column 6, lines 35-38), which read on,

wherein at least one polishing additive is both a compound selected from the group as recited in (a) and (b);

wherein the system further comprises a source of ammonia, **in claim 20;**

wherein the system comprises (i) aminotri-(methylenephosphonic acid) and (ii) ammonia or an ammonium salt, **in claim 21;**

wherein the system further comprises ammonia or an ammonium salt, **in claim 35;** and

wherein the system further comprises at least one stopping compound, **in claims 22 and 33.**

Kaufman further teaches, "The metal oxide abrasive may be selected from the group including alumina, titania, zirconia, germania, silica, ceria and mixtures thereof" (column 4, lines 47-50), which reads on the abrasives as recited **in claims 25-27.**

Kaufman differs in failing to teach at least one passivation film forming agent, **in claim 1;** which comprises one or more 5-6 membered heterocyclic nitrogen-containing rings, **in claims 8 and 16;** and is selected from the group as specified **in claim 24.**

Sasaki teaches, "Examples of the chemical agents forming a protection film by reacting with the aforementioned material containing a metal as a main component include benzotriazole (hereinafter, referred to as "BTA"), BTA derivatives including tryltriazole (TTA) . . . , azole (in particular, benzimidazole), triazole, . . . , amino acids containing sulfur (in particular, cysteine), . . . thiols such as phosphonic acids (e.g., dodecylmercaptan and octanephosphonic acid), and mixtures of the above-mentioned compounds. . ." (column 3, lines 38-54).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman's slurry by adding benzotriazole as taught by Sasaki, for the purpose of suppressing oxidation or corrosion of copper (Sasaki, column 5, lines 9-10 and 16-18).

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('489) in view of Sasaki ('095) as applied to claim 1 above, and further in view of Watts et al. (US 5,897,375).

Kaufman in view of Sasaki differs in failing to teach a nonaqueous solvent.

Watts et al. teaches, ". . . a new slurry for use in . . . (IC) industry in order to form . . . (CMP) copper interconnects. In particular, the slurry taught herein contains . . . an abrasive slurry . . . , and a balance of a solvent such as deionized water or an alcohol (same as applicant's nonaqueous solvent)" (column 2, lines 27-34).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Sasaki by employing a cmp slurry comprising alcohol as taught by Watt et al. for the

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purpose of improving the removal rate of copper . . .” (Watts et al., column 2, lines 38-41).

5. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman (US ‘489) in view of Sasaki (US ‘095) as applied to claim 1 above, and further in view of Hudson (US 5,972,792).

Kaufman in view of Sasaki differs in failing to teach the abrasive is fixed on the polishing pad, **in claim 5** and no abrasive is present in the system and the polishing pad is a non-abrasive pad, **in claim 6**.

Hudson teaches, “The polishing pad may be a conventional polishing pad made from a non-abrasive material (e.g., polyurethane), or it may be a new generation fixed-abrasive polishing pad made from abrasive particles fixedly dispersed in a suspension medium. The planarization liquid may be a conventional CMP slurry with abrasive particles and chemicals that remove material from the surface of the wafer, or it may be a solution without abrasive particles. . . .” (column 1, lines 16-24).

It is the examiner position that it would have been obvious to one having ordinary skill in the art to modify Kaufman in view of Sasaki by employing Hudson’s conventional polishing pads that contain non-abrasive or abrasive materials along with a CMP slurry that comprises either abrasive or non abrasive particles for the purpose of obtaining the claimed invention.

6. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman (‘489) in view of Sasaki (‘095) as applied to claim 1 above, and further in view of Watts et al. (US 6,096,652).

Kaufman in view of Sasaki differs in failing to teach the system comprises at least one polishing additive in both (a) and (b) as recited in the claim.

Watts ('652) teaches a method of planarizing a copper layer with a chemical solution comprising: a first and a second coordinating ligand. The first coordinating ligand comprises a material selected from the group consisting of thioethers (same as applicant's additive in (b)) and the second from the group consisting of amines (same as applicant's additive in (a)).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Sasaki by employing Watts' ('652) ligands (same as applicant's additives) for the purpose of achieving a rapid removal rate, and significantly lowered corrosion, of the copper layer as compared to a CMP method that uses no Cu(I) or Cu(II) coordinating ligands, or only one of such coordinating ligands, in the medium (Watts ('652), column 3, line 45-51).

7. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('489) in view of Sasaki ('095) as applied to claim 1 above, and further in view of Muroyama (US 5,709,588).

Kaufman in view of Sasaki differs in failing to teach at least one polishing additive is iminodiacetic.

Muroyama teaches, "the slurry includes polishing particles treated with a surface finishing agent having at least a carboxyl group containing material, . . ." (column 2,

lines 41-45). "Specific examples of the carboxyl group containing materials include . . . iminodiacetic acid" (column 3, lines 13-18).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Sasaki by employing Muroyama's iminodiacetic acid for the purpose of providing a slurry having polishing particles simply surface treated, which is capable or stably polishing in interlayer dielectric film and a metal interconnection layer while suppressing occurrence of scratches on the surfaces thereof. . . ." (Muroyama, column 2, lines 22-28).

8. Claim 23 and 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('489) in view of Sasaki ('095) as applied to claim 1 above, and further in view of Prigge et al. (US 4,968,381).

Kaufman in view of Sasaki differs in failing to teach the system comprises at least one polymeric compound that reduces the polishing rate of at least one layer associated with the substrate.

Prigge teaches using a conventional polishing agent in addition to a small quantity of polyvinyl alcohol to produce substantially haze-free semiconductor surfaces as described in British patent specification No. 1,418,088, (DT-OS 2,247,067), (column 1, lines 31-36). Polyvinyl alcohol is an example of a polymeric compound that is described in applicant's Specification (page 11, lines 34ff). Since Prigge's polyvinyl alcohol is used in polishing a semiconductor surface and is the same as applicant's polymeric compound, then using the polyvinyl alcohol in a polishing agent in the same

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manner as that of the claimed invention would result in a polymeric compound that reduces the polishing rate of at least one layer associated with the substrate.

Hence it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify the combination of Kaufman in view of Sasaki by using a polymeric compound such as polyvinyl alcohol that is taught by Prigge for the purpose of obtaining a haze-free semiconductor surface (Prigge, column 1, lines 31-36).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

ltue

September 8, 2003

NADINE G. NORTON
PRIMARY EXAMINER

